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XV.—*On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia.* By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

[With nine Plates.]

THE following paper has been drawn up from an examination of specimens collected by the Rev. W. B. Clark and sent to the Rev. Prof. Sedgwick, who kindly allowed the writer to make this use of them.

The species will be first noticed, and the new forms described, after which some observations will be offered on the relative ages of the Australian coal-fields, from a comparison of their organic remains with each other, and with those of other countries; premising that the extent of our materials enables this to be attempted in a more extended and precise manner than heretofore, and that several of the new forms described are calculated to throw much light on the fossils of our own country.

In this first part of my paper I wish to express my obligations to the Rev. Prof. Henslow and Mr. Babington for the kindness with which they allowed me the use of their herbaria on all occasions when I found it necessary to work out for myself points of structure in recent plants, neglected by botanists and omitted in their works, but which are of the highest importance in the investigation of fossil plants. To the facilities afforded by the former for my examination of the New Holland plants growing in the houses of the Cambridge Botanic Garden, I am mainly indebted for the maturing my views of the affinities of the genus *Phyllotheca*.

PLANTÆ.

Class ACROGENS. (*Al. Lycopodales.*)

Ord. MARSILEACEÆ (?).

*Vertebraria* (Royle).

This genus has been proposed by Prof. Royle in his 'Illustrations of the Botany of the Himalaya Mountains' for two species  
*Ann. & Mag. N. Hist. Vol. xx.* 11

of fossil plants from the supposed oolitic coal-field of Burdwan, but without any description or definition. Similar bodies are not uncommon in the shales and clays of the Australian coal-fields; but although the genus is noticed by Unger in his 'Conspectus Floræ Primordialis,' and Mr. Morris has noticed its occurrence in this district, no botanist has as yet given any descriptive account either of the genus or species; and so obscure are the relations to other forms, that doubts have even arisen as to what part of the plant the radiated cylindrical fossils might be supposed to represent, and how its parts should be named. A distinguished botanist has suggested to me that the cylindrical fossil might be considered a stem, the axis being the pith, the radiating divisional lines the medullary rays, and the intervening cuneiform masses the wedges of wood. I have carefully considered this opinion, but find it impossible to adopt it, from the ease with which the transverse fractures take place, and the perfection of the surfaces produced, as it is obvious that such numerous and perfect divisional planes, as we observe at right angles to the axis, would be incompatible with the above view. On the whole, after a careful study of the specimens at my disposal, I feel disposed to view the genus as closely allied to *Sphenophyllum*, in which we have a jointed stem surrounded by verticillate whorls of from six to twelve wedge-shaped leaves with dichotomous veins; and in this light *Vertebraria* becomes intelligible, for I have clearly ascertained the existence of the dichotomous neuriation on each of the wedge-shaped divisions of the transverse planes, which will, according to this view, represent the surface of a whorl of verticillate leaves, and we may consider therefore the main difference between *Sphenophyllum* and *Vertebraria* to consist in the greater approximation of the whorls of leaves in the latter, the internodes being so very short that the whorls of leaves are brought in contact, or nearly so. I might therefore provisionally characterize the genus as follows:—

*Gen. Char.* Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuriation.

To the above we might add, that the number of leaves in a whorl depends on the species, and that from the whorls being so close as nearly to touch each other, the fossils have the appearance of lengthened cylinders, breaking readily in a horizontal and vertical direction—the former coinciding with the surfaces of the leaves, the latter coinciding with the vertical prolongations of the lines separating the leaves of each whorl—the former producible in indefinite number at distances of about a line from each other, the latter having only a small definite number depending

on the number of leaves in a whorl. The leaves themselves are flat, rather thick, dilated at the tip in such proportion that there is no space left between the edges of the adjacent leaves.

It is very possible that together with *Sphenophyllum* these may have been freshwater aquatic plants allied to the recent *Marsilea*, in which we see a quaternary arrangement of cuneiform leaves with dichotomous veins, but the affinity is not very strong. The Australian species seems distinct from either of those occurring in the Indian beds by the smaller number of leaves in the whorl, which is perfectly constant in all the examples I have seen. I would propose to name and characterize our species as follows:—

*Vertebraria australis* (M'Coy). Pl. IX. fig. 1.

*Sp. Char.* Leaves constantly eight in each whorl.

The fragments are of various lengths, but with a pretty uniform diameter of about seven lines. The radiating dichotomous veins are never strongly marked, apparently from the original softness of the texture of the leaf; in many cases we observe between them an obsolete concentric plication, probably from the same cause, and which may explain the nature of certain vertical striæ visible on the perpendicular fracture, crossing the horizontal lines which mark the edges of the leaves.

This species is abundant in the whitish shales and clays of Mulubimba, N. S. Wales.

(*Al. Filices.*)

Ord. GLEICHENIACEÆ.

*Gleichenites odontopteroides* (Mor.) sp.

*Syn. Pecopteris odontopteroides* (Mor.) in Strzelecki's N. S. Wales.

Having obtained a finely preserved frond of this plant distinctly forked in the manner of *Gleichenia*, I have removed it from *Pecopteris*, in which it was placed by Mr. Morris, and transferred it to the order *Gleicheniaceæ* without hesitation; and taking the verbal characters of Göppert's genus *Gleichenites*—"Frons dichotoma pinnata. Fructificatio hucusque ignota,"—I think there can be no objection to placing it in that genus, although very distinct from his two species *G. artemisiæfolius* and *G. critmifolius*. I might also suggest its relation to the Lias and Keuper genus *Heptacarpus*, with some of the German species of which it generically coincides.

In the sandstone of Clark's Hill, N. S. Wales.

Ord. NEUROPTERIDES.

*Odontopteris microphylla* (M'Coy). Not figured.

*Sp. Char.* Bipinnate; pinnæ alternate, oblique, narrow, about 11\*



three lines wide and two inches long ; pinnules alternate, oblique, slightly connate at the base, obtusely elliptical, their length only equalling the width of their base ; no midrib, secondary neuration indistinct.

The only *Odontopteris* approaching this elegant species by its alternate pinnæ and very short connected pinnules is the *O. Schlotheimii* (Br.), from which it is distinguished by the smaller size, much narrower and more oblique pinnæ, and by the pinnules being proportionally smaller and elliptical instead of broadly rounded. The latter character also separates it from the so-called *Pecopteris Desnoyersii* (Br.) of the 'Oolithe à Fougères' of Marmers, Sarthe.

Common in the fine sandstone of Clark's Hill, N. S. Wales.

#### *Otopteris*, Lind. and Hut.

With Messrs. Lindley and Hutton I use this term for those pinnated plants, the leaves of which agree with *Cyclopteris* in their neuration. Some of these forms were originally described by Lindley and Hutton (Fossil Flora) as *Cyclopteris*, under the impression that the rachis was a rhizoma; Brongniart (Prodrome and Hist. des Végétaux Foss.) gives several of them as *Neuropteris*, apparently neglecting the important character of want of midrib. Göppert confounds both the simple and compound fronds in his *Adiantites* (Syst. Fil. Foss. in Nova Acta Acad. Cæs. Leop. Cur. Nat.), and Unger does the same under the head *Cyclopteris* (Chloris Protogæa). I have however thought it desirable to use the term for the pinnate species for which it was proposed, and thus retain *Cyclopteris* for the simple, entire fronds, in accordance with the original view of Brongniart.

#### *Otopteris ovata* (M'Coy). Pl. IX. fig. 2.

*Sp. Char.* Frond pinnate ; rachis very thick, slightly flexuous ; leaflets little longer than wide, ovate, pointed ; upper lobe of the base nearly twice the size of the under, the contracted, thickened base set obliquely on the rachis ; veins fine, divaricating, very frequently dichotomizing, nearly equal, but fasciculated at the base.

The fasciculation of the nerves at the base resembles that of the *Cyclopteris flabellata*. The regular, short, semi-elliptical form of the leaflets distinguishes this from the other species of the genus. The average length of the leaflets in the examples I have seen is about 8 lines, width 7 lines, width of rachis  $1\frac{1}{2}$  line. Occurs in the hard siliceous flags of Arowa, N. S. Wales.

#### *Cyclopteris angustifolia* (M'Coy). Pl. IX. fig. 3 & 3 a.

*Sp. Char.* Leaf linear, lanceolate, eight or nine times longer than

wide; sides straight, nearly parallel, pointed above, contracted to a lengthened petiole below; nerves equal, those of the middle third of the frond nearly parallel, straight, rather closer than those of the sides, which gradually divaricate towards the margin at a very acute angle; all the nerves dichotomise at irregular intervals, and those of the sides occasionally anastomose and are connected by a few transverse bars.

In this curious plant we have, as it were, a connecting link between the genera *Cyclopteris* and *Glossopteris*, for although the specimen I have drawn only exhibits the middle portion of the frond, yet I have ascertained that the form is precisely that of a narrow *Glossopteris*, being elliptical or pointed at the apex, and tapering gradually to a lengthened petiole at the base, and still further agreeing in the occasional anastomosing of the lateral veins, and their being connected, though rarely, by transverse bars; yet it is impossible to refer it to that genus from the want of the strong, characteristic midrib, the place of which is occupied by numerous dichotomous nerves of nearly the same thickness as those of the sides; I am therefore obliged to refer it to *Cyclopteris* from a consideration of its more important characters, although differing remarkably in form from the other species of the genus as above restricted. The portion figured, of the middle of a frond, measuring  $3\frac{1}{2}$  inches in length, and 9 lines wide at the base, only tapers 2 lines.

This species seems common in the gray shale of Guntawang, Mudgee, N. S. Wales.

Ord. SPHENOPTERIDES.

*Sphenopteris lobifolia* (Mor.).

Common in dark brown shale, Mulubimba, N. S. Wales.

*Sphenopteris alata* (Br.) sp.

Of large size in the fine gray sandstone of Mulubimba, N. S. W.

*Sphenopteris hastata* (M'Coy). Pl. X. figs. 1 & 1 a.

*Sp. Char.* Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulato-dentate, having three obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

The lengthened oval form, slightly indented margin, and simple neuration of the pinnules fully distinguish this from any published species of the genus. The average length of the pinnæ is about  $1\frac{1}{2}$  inch, width 4 lines, average length of leaflets 3 lines.

Not uncommon in the shale of Mulubimba, N. S. Wales.

*Sphenopteris germanus* (M'Coy). Pl. X. figs. 2 & 2 a.

*Sp. Char.* Bipinnate; pinnæ oblique, alternate elongate, ovate, with a narrow membranous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three-lobed; nerves bipinnate, three branches reaching the margin of each lobe.

It is extremely difficult to distinguish this species from the *Pecopteris Murrayana* of the Yorkshire oolitic coal-fields, with which it is nearly identical in form and neuration. The oval outline of the pinnules is the most obvious character, contrasting with the trigonal, wide-based leaflets of the English plant; this, together with their more oblique setting on the rachis, more oblique, narrow and deeply-cleft lobes, and the decurrent, narrow, alate margin to the straight rachis, will I think be sufficient to distinguish the species.

In the shale of Mulubimba, N. S. Wales.

*Sphenopteris plumosa* (M'Coy). Pl. X. figs. 3 & 3 a.

*Sp. Char.* Bipinnate; pinnæ curved, elongate, narrow, plumose, with a scarcely alate margin to the rachis; pinnules close, oblique, ovate, pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; nerves strong, much-branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin.

The number of lobes of the leaflets and complexity of the neuration will readily distinguish this species. The average length of the leaflets 5 lines.

Rare in the shale of Mulubimba, N. S. Wales.

*Sphenopteris flexuosa* (M'Coy). Pl. IX. figs. 4 & 4 a.

*Sp. Char.* Bipinnate; pinnæ very long, with a strongly flexuous naked rachis; pinnules large, moderately oblique, unequal, ovate, sides cut into two very large obtusely rounded lobes on each side; apex trilobed; nerves strong, much-branched, seven branches reaching the margin of each lateral lobe, and three going into each of the three lobes of the apex.

This strongly-marked species is not sufficiently allied to any published form to render a comparison necessary. The average length of the leaflets is about 8 lines, width 4 lines.

In a brown bed of clay, Mulubimba, N. S. Wales.

#### Ord. PECOPTERIDES.

##### *Glossopteris Browniana* (Br.).

I think I recognise both the Indian and Australian forms of

this species (vars. *a.* and *β.* of Brongniart) in nearly equal abundance among the specimens examined, and some of the fronds are of a size far exceeding any hitherto published, some of them being six inches wide, which in the proportion of the small, perfect examples would indicate a frond of more than two feet in length. I believe I have ascertained the rhizoma of this species, which is furnished with ovate, clasping (or at least very convex) subcarinate scales, having a divaricating reticulated neuration, resembling that of the perfect frond, but much less strongly marked; these scales are of large size, some of them being nearly an inch in length, and terminating at the apex in a long flat linear appendage, about one line in width, which occasionally gives off small, lateral, flat, membranous branches nearly at right angles; the whole perfectly resembling (except in size) the rhizomal scales of *Acrostichium*, *Laromanes* and *Hymenodium*, as figured by M. A. Fée in his beautiful 'Mémoire sur la Fam. des Fougères,' and when combined with the great similarity in form, habit and neuration, would warrant us in presuming a strong affinity to exist between these genera.

Abundant in the soft reddish shales of Jerry's Plains, and also in the black shales and white clay beds of Mulubimba, N. S. W.

*Glossopteris linearis* (M'Coy). Pl. IX. figs. 5 & 5 a.

*Sp. Char.* Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50° with the midrib, anastomosing occasionally from the midrib to the margin.

It is only with the *Glossopteris angustifolia* (Br.) from the Indian coal-fields of Rana-Gunge, near Rajemahl, that this long, parallel-sided frond could be confounded, and it is distinguished easily from that species by the fineness of the neuration, which is as remarkably delicate as that of the other is coarse; the neuration of the *G. angustifolia* is also distinguished by its great obliquity, forming an angle of about 30° with the midrib, while the nerving of the present species is not more oblique than that of the *G. Browniana* or *G. Nilsoniana*. In this species also, from the anastomosing being continued up to the margin, it results that the nerves are little closer at the margin than at the middle of the leaf, while in the *G. angustifolia* the anastomosing is confined to the central portion, and the dichotomising goes on to the margin, where in consequence the neuration is finer and closer than towards the midrib. None of the specimens are perfect at the extremities, the largest being three inches long and seven lines wide at the basal fracture, and diminishing about two lines in that length towards the distal end, being about eight lines



wide in the middle. Disconnected fragments show that the base diminishes insensibly to a lengthened petiole, as in the *G. Browniana*, and that the apex is elliptical and pointed.

Very abundant in the gray shale of Wollongong; not uncommon in the hard siliceous schists of Arowa, N. S. Wales.

*Pecopteris* ? *tenuifolia* (M'Coy). Pl. IX. fig. 6.

*Sp. Char.* Bipinnatifid (?); pinnules and rachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

If this be truly a *Pecopteris*, it is distinct from all others by its very narrow, linear leaflets. The only plant I have seen at all resembling it is the *Zamites obtusifolius* from the shale of the oolitic coal-fields of Blackheath, Richmond, United States, exhibited some weeks since by Mr. Lyell to the Geological Society. The specimens alluded to of this latter plant seem imperfectly preserved, but still show, on some portions of the pinnules, a neuration running parallel with a strong midrib. This great midrib seems to me incompatible with *Zamites*, so that although I point to the resemblance between the American and Australian plants, I prefer placing the latter provisionally in *Pecopteris*, as I have seen no trace in my imperfectly preserved specimens of a parallel neuration; and even if it should hereafter be found to exist, I conceive it would be necessary to form a new genus, intermediate in form, neuration, and (I think) mode of attachment of the pinnules to the rachis, between *Zamites* and *Pecopteris*, for the reception of those two plants.

One specimen has occurred in the fine sandstone of Clark's Hill, N. S. Wales.

Class ENDOGENS. (*Al. Palmales.*)

Ord. PALMACEÆ.

*Zeugophyllites elongatus* (Mor.).

Common in the shales of Mulubimba, N. S. Wales.

Class EXOGENS. (*Al. Amentales.*)

Ord. CASUARINACEÆ (?).

*Phyllothea* (Br.).

M. Brongniart, in his 'Prodrome,' finds this genus for a single species, the *P. australis*, of which he mentions having a large number of well-preserved specimens, which he describes as "des tiges simples, droites, articulées, entourées de distance



en distance par des gâines appliquées contre cette tige, comme dans les *Equisetum*, mais terminées par de longues feuilles linéaires, qui remplacent les dents courtes des gâines des Prêles. Ces feuilles sont, ou dressées, ou plus souvent étalées, et même réfléchies; elles sont linéaires, aiguës, sans nervure distincte, au moins deux fois plus longues que la gâine. Les gâines elles-mêmes présentent de légers sillons longitudinaux, qui disparaissent vers la base, et qui semblent correspondre à l'intervalle des feuilles, comme les sillons des gâines des *Equisetum* correspondent à l'intervalle des dents. La tige, dans l'espace qui sépare les gâines, paroît lisse; mais sur des fragmens de tiges un peu plus grosses, qui appartiennent probablement à des individus plus âgés, de la même plante, on voit des stries régulières, presque comme sur les Calamites." While, on the other hand, Messrs. Lindley and Hutton in their 'Fossil Flora' (article *Hippurites gigantea*) state, that having examined specimens communicated by Dr. Buckland (from whom also Brongniart received his), they found Brongniart's description inaccurate, and that the leaves, instead of springing from the edge of the sheath, arise immediately from the stem, and having in addition to the whorl of distinct leaves "a sheath originating within them and closely embracing the stem, to which it gives the appearance of the barren shoots of an *Equisetum*, with its whorls of slender branches on the outside of a toothed sheath." Unger, in his 'Chloris Protogæa,' referring both to Brongniart and Lindley and Hutton, defines the plant as "Caulis simplex, rectus, articulatus vaginatusque. Folia verticillata linearia, enervia contracta v. expansa, vaginas articulorum strictas circumdantia." Mr. Morris, I believe the latest writer on this plant, closely follows Brongniart in his observations on its structure.

I have now stated what I believe to be all the published information regarding this very interesting form, and as it has not been hitherto figured, and the published accounts are contradictory among themselves, and none of them as I find strictly applicable to the plant, it may be interesting to detail some of the observations I have been enabled to make on those specimens which have come under my notice.

I find in the whitish clay beds of Mulubimba a profusion of plants having cylindrical jointed stems, the joints surrounded by sheaths, and the free edge of each sheath terminating in a whorl of long, linear leaves. Here we have all the essential characters of *Phyllothea*, but beyond this there is no agreement with the descriptions of those few botanists who have seen the plant. And here I may be permitted to state, that from the number of specimens which I have examined with great care, there remains not a doubt on my mind of the accuracy of M. Brongniart's view of

the relation of the whorls of leaves to the sheaths : I have traced them distinctly in every instance as arising from the free edge of the sheath, and lying either straight, inclining obliquely outwards, or, as is most commonly the case, completely reflexed, as I have represented in the drawing Pl. XI. fig. 2 : and their occurrence in this position may have deceived Messrs. Lindley and Hutton as to their real connexion with the sheaths ; for when the long slender leaves are completely reflexed and pressed in a reversed position against the sheaths, broken specimens may easily have their inferior mistaken for their superior extremities ; and if when in this position the leaves be supposed to point upwards, they will really have the appearance of originating as an independent whorl of leaves *outside of the base of the sheath*, as described in the 'Fossil Flora.' This double arrangement would be so anomalous, that it is the more important to have the means of ascertaining the true relation of those parts in accordance with Brongniart's original view.

Brongniart describes the stem as smooth, and I find the specimens before me apparently divisible into two groups, one having the stem smooth, the other having it coarsely sulcated longitudinally, as in *Calamites*. All the botanists alluded to agree in describing the stem of *Phyllothea australis* as simple ;—*all the sulcated stems* I have seen are simple, but a number of the smooth or slightly striated stems are distinctly branched, and in a manner quite distinct from *Equisetum*. In *Equisetum*, if we view with most botanists the sheaths as produced by the mere lateral union of the leaves, and thus representing the foliage of other plants, we have the extraordinary character of the branches arising, not as axillary buds originating immediately above and within the base of the leaves, but originating *below* the joints and external to the sheaths. This is not the case with the fossil before us, in which the branches originate directly over the joints, and are therefore within and axillary to the sheaths, which may thus, with their appendages, be considered as true leaves, and having the same relation to the branches as in ordinary plants. This character is of such importance, that the resemblance of *Phyllothea* to *Equisetum* is proved by it to be of the most trifling nature, and that there can be no real affinity between them. On the other hand, when compared with *Casuarina*, the affinity seems to me to be exceedingly strong, although botanists have not, I believe, hitherto so considered it. The *Casuarinæ* are exogenous weeping trees, with slender cylindrical branches, their shoots regularly jointed, longitudinally sulcated, and surrounded at the joints with toothed sheaths as in *Equisetum* ; while the branches originate either in a verticillate or irregular manner immediately above the joints and within the sheaths, showing a perfect agreement with

the above-mentioned *Phyllotheca*. But a still more interesting and important proof of the relation of those plants to *Casuarina*, and removing them still farther from *Equisetum*, is to be found in their mode of inflorescence, of which I have fortunately noticed a fragment among the specimens at my disposal. The specimen alluded to is a portion of a branch (see Pl. XI. fig. 1) with the joints more approximate than on other parts of the plant, their length being scarcely equal to their diameter; the sheaths are the exact length of the internodes, and fringed on their upper margin with a dense little whorl of (I think two-celled) anthers, agreeing very closely with the male flowers of *Casuarina stricta* and allied species, with which (being in flower at this time in the houses of the Cambridge Botanic Garden) I have been enabled to compare it as advantageously as the state of preservation of the fossil would allow. The fructification of *Equisetum* is entirely different, forming a dilated, club-shaped mass at the end of the branches or at the extremity of a particular stem. The *Phyllotheca australis* is described as having the sheaths closely applied to the stem, the leafy appendages twice the length of the sheaths, without midribs, and having the naked portion of the stem between the sheaths smooth. Of the two species which I have seen this would best agree with the branched one, which however has a midrib, although not a very prominent one. The species which agrees with the definition in being simple-stemmed, differs in having the sheaths very loose or infundibuliform, and so long as to extend the entire way from one joint to the next, so as to leave no bare space of the stem visible; the leaves are very long and have a strong prominent midrib, and the stem when deprived of the sheaths is seen to be always coarsely sulcated. Under these circumstances the obvious course seems to be to modify the definition of the genus so as to include the two species under consideration, and to characterize them as distinct species. If the supposed affinity with *Equisetum* were borne out, I should probably have considered the loose-sheathed, simple-stemmed plant as the fertile shoot, and the branched stems with small tight sheaths as the barren shoots, following the analogy of some of our best-known recent species of *Equisetum*; but having seen that they are constructed in an essentially different manner, we cannot do better than as I have proposed. I may then briefly characterize the genus and species as follows:—

*Phyllotheca*.

*Gen. Char.* Stem slender, jointed, simple or branched; branches springing from above the joints, not arranged in the same plane; surface smooth or longitudinally sulcated; articulations surrounded by sheaths, the free edge of which terminates



in long narrow leaves, having a more or less distinct midrib. Inflorescence arranged in whorls near the extremity of certain branches.

I have only to add to the above characters, that the ridges of the sulcated stems do not alternate at the joints in the regular manner of *Calamites*, nor is there any trace of the peculiar tubercles so generally seen in that genus (an additional proof, if such were wanting, that Brongniart's original explanation of those tubercles being connected with the vascular system of the sheath is not the correct one, for here we have enormously developed sheaths and no tubercles). The verticillate whorls of leaves, whenever I have seen them perfectly expanded, seemed always elliptical as in *Annularia*, the leaves of two opposite points of the circumference being considerably longer than the rest. The genus is distinct from *Annularia* by the great development of the sheath or connected base of the leaves, and by the branches being inconstant, and when present, not being arranged in pairs in the same plane.

*Phyllothea australis* (Br.).

*Sp. Char.* Stem simple, smooth or slightly striated; sheaths tight, shorter than the internodes, terminated by narrow leaves, double the length of the sheaths, without distinct midrib. (*Condensed from Br.*)

*Phyllothea ramosa* (M'Coy). Pl. XI. figs. 2 & 3.

*Sp. Char.* Stem branched, smooth or slightly striated; sheaths half the length of the internodes; leaves thin, linear, flat, twice to three times the length of the sheath, with a very fine indistinct midrib.

This beautiful plant has the branches weeping or hanging downwards as in *Casuarina*, about half the diameter of the stem; they do not arise from every joint, but they do nearly; I am uncertain whether more than one spring from any one joint. Most of the stems are perfectly smooth, being striated only at the articulation (see Pl. XI. fig. 3), while others have a delicate lineation down the internodes; the first I imagine to be stript of their bark, and the latter to retain it; and here again we have another proof of the stronger affinity of our fossil to *Casuarina* than to *Equisetum*, for I find by examining the living *Casuarina* that the lineation of the surface goes no deeper than the bark, while the elevated lines on the surface of *Equisetum* are only the edges of strong septa going towards the central hollow, and the flat spaces between those lines are only the superficial coverings of tubular hollow spaces between the aforesaid septa, so that de-



stroy the surface of *Casuarina* and you render the stem smooth—destroy the surface of *Equisetum* and you only increase the coarseness and strength of the sulcation. I may also add (in accordance with this view) that age or size has no connexion with this lincation of the surface, as is suggested by M. Brongniart in the last few lines of the quotation from his work at the head of this subject, for I find some of the largest stems perfectly smooth and the smallest occasionally striated. The sheaths are rather coarsely striated, and terminate in thin, flattened leaves, the midrib of which is scarcely discernible. In the weeping or downward curved branches the leaves are completely reflexed so as to point upwards, and according to the position of the stem, are either reflexed, expanded, or lying straight up against the stem. The stems vary from 3 to 7 lines in diameter.

Common in the white soft shale of Mulubimba, N. S. Wales.

*Phyllothea Hookeri* (M'Coy). Pl. XI. figs. 4, 5, 6, 7.

*Sp. Char.* Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose, subinfunduliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong, prominent midrib.

This species is easily known from the two former by its great loose sac-like sheath, completely concealing the stem (see Pl. XI. figs. 4 & 5), its long, thick, strongly ribbed leaves (see Pl. XI. fig. 6), and by its stem when stripped of its sheath being coarsely and regularly sulcated, precisely as in the *Calamites Cistii* (see Pl. XI. fig. 7). Although abundant, I have never seen a trace of a branch. Some of the flattened stems attain a width of two inches.

Common in the sandstone of Clark's Hill, in the siliceous schists of Arowa, and in the shales at Mulubimba, N. S. Wales.

[To be continued.]

XVI.—*Note on the Teredo norvegica* (T. *navalis*, *Turton*, not *Linn.*), *Xylophaga dorsalis*, *Limnoria terebrans* and *Chelura terebrans*, combined in destroying the submerged wood-work at the harbour of *Ardrossan* on the coast of *Ayrshire*. By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast\*.

IN the Edinburgh 'Philosophical Journal' for January 1835, I published a memoir entitled, "On the *Teredo navalis* and *Lim-*

\* Read at the Meeting of the British Association at Oxford in June last.